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June 25, 2009

5218-02

Mr. Brad Hess, Assistant Administrator
Cancer Center of Santa Barbara
540 West Pueblo Street
Santa Barbara, CA 93105

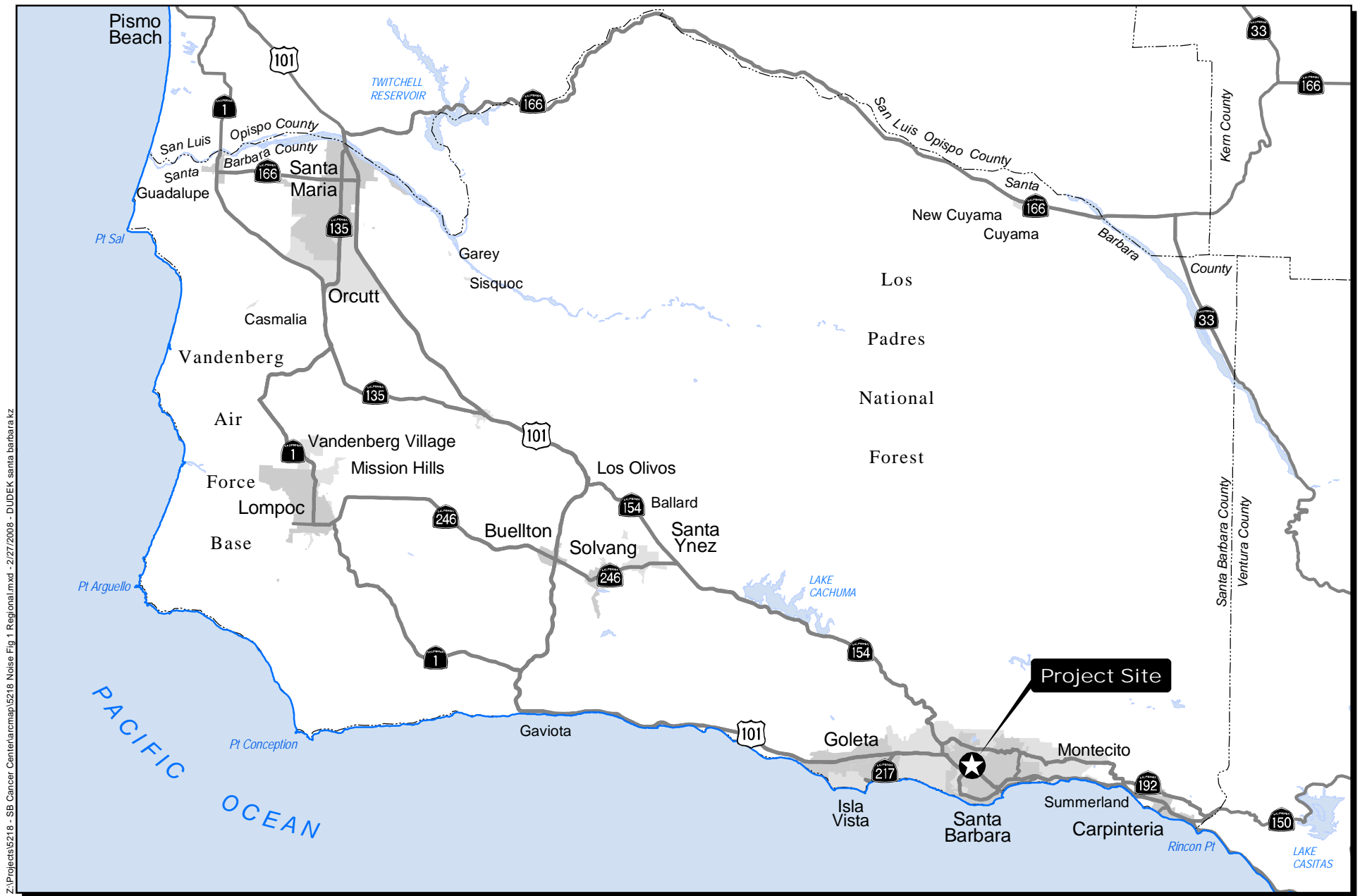
***SUBJECT: Santa Barbara Cancer Center Project
Environmental Noise Study Report – Revision 2***

Dear Mr. Hess:

Dudek is pleased to submit this revised Environmental Noise Study Report for the proposed Santa Barbara Cancer Center project located at 540 West Pueblo in the City of Santa Barbara, California (*Figures 1 and 2*). The revisions in this report are intended to address the City of Santa Barbara's Planning Division May 20, 2009 DART comments to Dudek's Environmental Noise Study dated March 9, 2009.

This report presents a summary of the City's Noise Criteria applicable to the project (*Section 1*), a discussion of the Project Background and Setting (*Section 2*), the Existing Noise Environment (*Section 3*), a Future Vehicle Noise Impact Analysis (*Section 4*), an Oaks Nursery Preschool Playground Noise Impact Analysis (*Section 5*), Combined Traffic and Playground Noise Impact Analysis (*Section 6*), a Construction Noise Impact Analysis (*Section 7*), and a Mechanical Equipment Noise Impact discussion and recommendations (*Section 8*).

The Project Site Plan used for the analysis was prepared by Cearnal Andrulaitis LLP, dated 2/4/09. Traffic data used in this analysis are based on information provided by Associated Transportation Engineers (ATE). A glossary of acoustical terms and definitions used in this report is included in Attachment A.



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Environmental Noise Study - Santa Barbara Cancer Center
Regional Setting



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1.0 NOISE CRITERIA AND THRESHOLDS

The City of Santa Barbara's noise standards are primarily contained within the City's General Plan Noise Element and the City's Noise Ordinance. The following is a summary of the sections of the City's Noise Element and Noise Ordinance that apply to the proposed project.

1.1 City's Noise Element

The City of Santa Barbara's Noise Element of the General Plan specifies Land Use Compatibility Standards applicable to new developments. The following exterior noise exposure levels are considered "normally acceptable" for the proposed project uses:

Maximum Exterior Noise Levels

- Residential uses: 60 Ldn
- Hospital uses: 65 Ldn

The "normally acceptable" 60 Ldn exterior noise exposure level for the residential uses is considered the maximum allowable exterior noise level for the residential private outdoor living areas, such as the project's ground floor private patios.

The City of Santa Barbara's maximum interior noise levels applicable to the habitable spaces within the proposed project uses are:

Maximum Interior Noise Levels

- Residential uses: 45 Ldn
- Hospital uses: 45 Ldn

1.1 City's Noise Ordinance

Noise impacts from construction and stationary sources are regulated through the City's Noise Ordinance. The City's Noise Ordinance, Chapter 9.16.015 - Construction Work at Night - includes guidelines applicable to the project's construction. The City's Noise Ordinance, Chapter 9.16.015 stipulates:

"It shall be unlawful for any person, between the hours of 8:00 p.m. of any day and 7:00 a.m. of the following day to erect, construct, demolish, excavate for, alter or repair any building or structure if the noise level created thereby is in excess of the ambient noise level by 5 dBA at the nearest property line of a property used for residential purposes unless a special permit therefore has been applied for and granted."

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The City's Noise Ordinance, Chapter 9.16.025 - Regulation of Noise Affecting Parcels Zoned or Used for Residential Purposes - includes guidelines applicable to the project's mechanical equipment noise levels. The City's Noise Ordinance, Chapter 9.16.025 Section C. Noise Limitations., stipulates:

"All mechanical equipment other than vehicles shall be insulated and sound at the property line of any adjacent parcel used or zoned for residential, institutional or park purposes shall not exceed sixty A-weighted decibels using the Community Noise Equivalent Level 60 dBA CNEL."

2.0 PROJECT BACKGROUND AND SETTING

The project proposes to reconstruct the existing Cancer Center Facility located at 540 West Pueblo Street. The proposed new medical facility development would be three stories, with a separate 4-level parking structure. The project proposes to remove seven existing residential units and to construct six new residential units at the site. Private outdoor living areas are proposed at the new residential units at the site in the form of ground floor patios or porches along West Junipero Street (*Figure 3*).

The project site is bounded by:

- West Junipero Street on the north;
- West Pueblo Street on the south;
- Commercial, Medical Office Buildings on the east;
- Oaks Nursery Pre-school and Mission Creek on the west.

Existing land uses near the site include:

- To the north: Oak Park and some single family residences.
- To the south: one apartment complex on the west side of Mission Creek, and a condominium complex on the east side of Mission Creek.
- To the east: medical office buildings between the project site and Oak Park Lane, residences, and medical offices.
- To the west: Mission Creek and the Oaks Nursery Preschool.

The principal contributor to the ambient noise environment at the project site is traffic noise from the US Highway 101. West Pueblo Street and West Junipero Street, adjacent to the site, are local collector streets, and vehicles along these streets are not anticipated to significantly contribute to the noise environment at the site.



Source: Boulder Associates Architects, Cearnal Andralaitis Interior Design

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3.0 EXISTING NOISE ENVIRONMENT

The project site is primarily exposed to traffic noise from the U.S. Highway 101. In addition, playground activities associated with the Oaks Nursery Preschool located to the west of the project site, maintenance and community/playground activities associated with Oak Park located to the north of the project site, and sirens from medical emergency vehicles and medical emergency helicopters traveling to Cottage Hospital contribute to the overall noise environment in the project area.

The U.S. Highway 101 carries a current traffic volume of approximately 138,000 average daily trips (ADT) (Source: ATE). Existing buildings between the project site and the US Highway 101 provide some vehicle noise shielding, and particularly reduce the US Highway 101 vehicle noise exposure to the site at ground floor level locations.

This section provides an evaluation of the existing noise environment in the project area, based on noise level measurements, field observations, and calculated existing Ldn noise levels.

3.1 Noise Level Measurements

Both short-term and long-term sound level measurements were conducted at the project site. The noise measurements were taken using a Rion NL 32 and a Larson Davis 820 integrating sound level meter, with A-weighting and "slow" response settings. These sound level meters meet the current American National Standards Institute standard for a Type 1 precision sound level meter. The sound level meters were calibrated before and after the readings.

3.1.1 Short-Term Noise Level Measurements

Short-term sound level measurements were conducted at the project site on February 27, 2008 and June 18, 2009. The short-term (15-minutes) noise level measurements are considered representative of the hourly noise level occurring at the monitor sites. The short-term sound level measurements were attended by a Dudek acoustician (i.e., performed by a person with training and experience in measuring environmental sound). In addition to operating the sound level meter, the acoustician actively observed and noted the acoustical, weather, and community activity conditions.

Simultaneous readings were taken at ground floor level (5 feet) and 2nd floor level (17 feet) at the site, near the proposed residential units along West Junipero Street, monitor location 1, *Figure 4*. The line of sight between the U.S. Highway 101 and ground floor monitor position was



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interrupted by buildings. The line of sight between the U.S. Highway 101 and 2nd floor monitor position was not interrupted by buildings or structures. The measurement at the second floor elevation is considered representative of unobstructed noise levels associated with US Highway 101 at this location, and was used to calibrate the vehicle noise prediction model.

During the measurement, the principal contributor to the ambient noise environment at the project site was traffic noise from the U.S. Highway 101. The U.S. Highway 101 traffic was observed to move smoothly during the measurements. Other noise sources observed during the measurements include vehicles driving by along West Junipero Street. However, due to their low volume and speed, these vehicles did not significantly contribute to the monitored noise levels. No other noise sources were observed during the measurements. The noise level measurement results are presented in *Table 1*.

A second short-term noise measurement was conducted at Site 3 adjacent to Mission Creek. This area represents the worst-case noise location for the garden outdoor use area. This area is partially shielded by intervening buildings. The measured average noise level was 62 dBA.

Table 1 Measured Noise Levels		
Monitor Location¹	Date/Time	L_{eq}²
Site 1; 5-feet above ground floor level	February 27, 2008 2:45 to 3:00 p.m.	54 dBA
Site 1; 17 feet above ground floor level		59 dBA
Site 3; 5-feet above ground floor level and 13-feet behind wrought iron/block wall	June 18, 2009 1:45 to 2:00 p.m.	62 dBA

Notes:

¹ See Figure 4

² Equivalent Continuous Sound Level (Time-Average Sound Level)

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3.1.2 Long-Term Noise Level Measurements

Long-term sound level measurements were conducted at the project site during weekdays on June 18 - 19, 2008, and the weekend of June 21 – 22, 2008 at monitor location 2, *Figure 4*. The unattended long-term sound level measurements were conducted with an automated sound level meter, recording hourly Leq noise levels during 24-hour periods.

Readings were taken at ground floor level (5 feet) at the site, near the proposed residential units along West Junipero Street (*Figure 4*). The line of sight between the U.S. Highway 101 and monitor position was interrupted by buildings.

The principal contributor to the ambient noise environment at the project site observed while setting up and collecting the sound level meters, was traffic noise from the U.S. Highway 101. Due to their low volume and speed, vehicles along West Junipero Street were observed not to contribute significantly to the monitored noise levels. Other noise sources observed at those times include weekday daytime hammering activities at a construction site to the east of the project site, and noise levels generated from maintenance and playground activities associated with Oak Park located to the north of the project site. No emergency vehicle sirens or helicopter flights traveling to Cottage Hospital were observed to occur at the time of equipment set up and collection, but are assumed to be captured in the composite noise sources occurring over the duration of the long-term noise measurements. No other noise sources potentially impacting the project site were observed during the measurements.

Note:

Noise levels from playground activities at the Oaks Nursery Preschool located to the west of the project site could not be monitored due to an instructional break for the school during fieldwork. Information provided by Oaks Nursery Preschool staff indicates that up to 45 children may be playing outside between 8:00 a.m. and 12:30 p.m. during the school season. Dudek staff previously monitored noise levels at several nursery school playgrounds indicating sound exposure levels from 1 child at 100 feet to range between 58 and 63 dBA. The above information has been used to analyze the potential noise impacts from playground activities at the Oaks Nursery Preschool upon the project site.

A summary of the 24-hour noise level measurements and the calculated 24-hour Ldn noise levels is presented in *Table 2*.

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TABLE 2
24-HOUR MONITORED NOISE LEVELS¹ (dBA)

Start Time	Weekdays June 18 - 19, 2008	Weekend June 21 - 22, 2008
12:00 PM	59	57
1:00 PM	57	57
2:00 PM	56	54
3:00 PM	56	55
4:00 PM	57	56
5:00 PM	57	56
6:00 PM	57	56
7:00 PM	55	58
8:00 PM	59	65
9:00 PM	57	55
10:00 PM	55	57
11:00 PM	53	54
12:00 AM	51	53
1:00 AM	51	50
2:00 AM	49	50
3:00 AM	46	48
4:00 AM	47	48
5:00 AM	49	49
6:00 AM	54	51
7:00 AM	57	53
8:00 AM	58	52
9:00 AM	60	54
10:00 AM	59	55
11:00 AM	58	54
Ldn	60	60

Notes:

¹ Equivalent Continuous Sound Level (Time-Average Sound Level)

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The weekday noise levels data shown in Table 2 indicate the monitored hourly Leq to range between 46 and 60 dBA, resulting in a calculated existing weekday Ldn noise level of 60 dBA. The weekend noise levels data shown in Table 2 indicate the hourly Leq to range between 48 and 65 dBA, resulting in a calculated existing weekend Ldn noise level of 60 dBA.

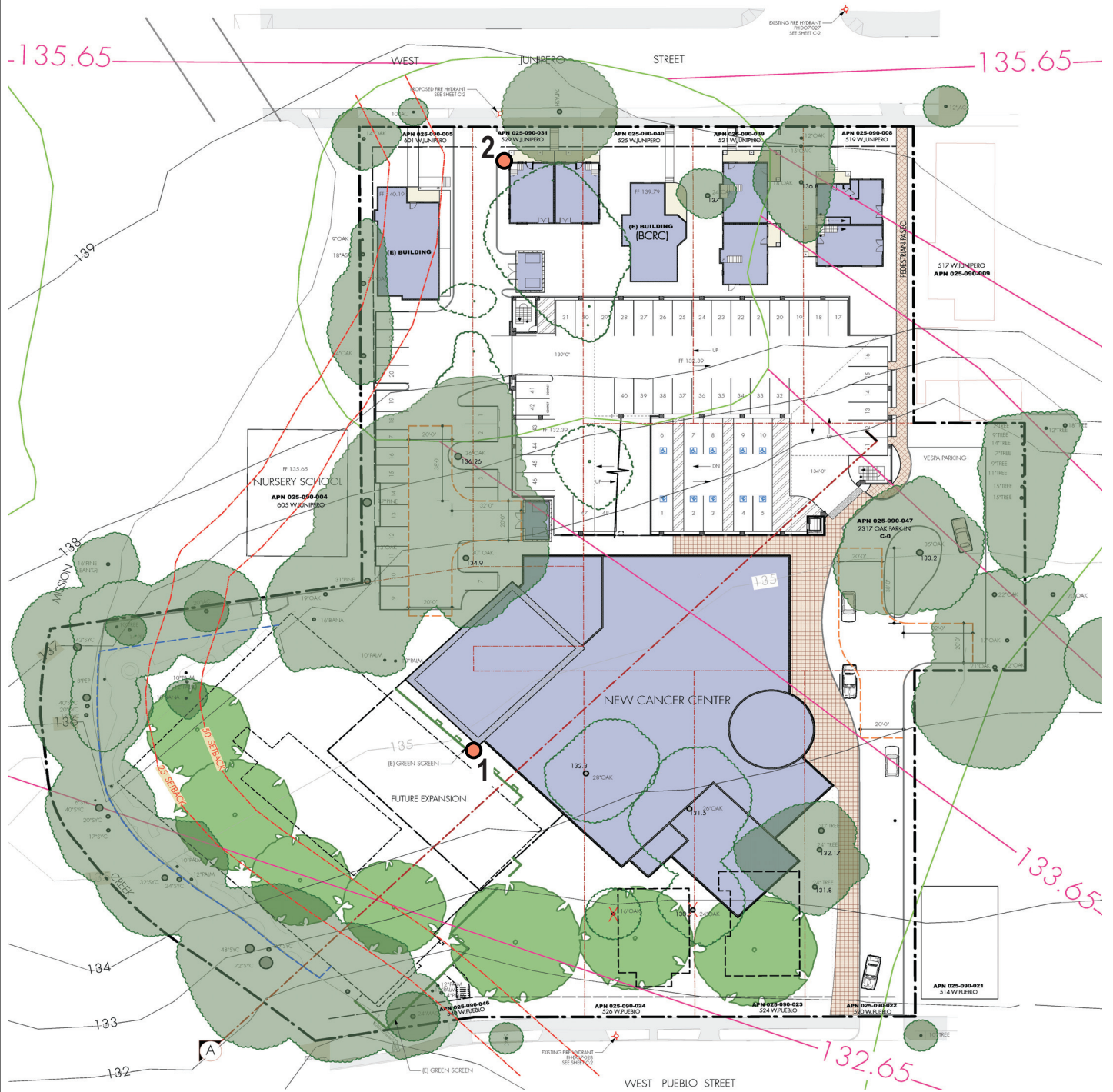
4.0 FUTURE VEHICLE NOISE ANALYSIS

The future (15 years out) U.S. Highway 101 noise exposure to the site was analyzed with an FHWA based computer model. A copy of the vehicle noise prediction model calculation sheets is included in *Attachment B*. The noise modeling locations are shown in *Figure 5*.

The vehicle noise prediction model was calibrated using the 59 dBA Leq monitored at the 2nd floor (Monitor Location 1, *Figure 4*, monitor results in *Table 1*). The difference between the monitored and calibrated noise levels is less than 0.5 dBA, which is well within the accuracy of the noise monitoring and modeling programs.

According to information provided by Associated Transportation Engineers (ATE), the existing traffic volume on the US Highway 101 section adjacent to the project site is 138,000 average daily trips (ADT). Year 2023 vehicle volumes were estimated based on a yearly 1.25% escalation factor. This results in a future ADT of 165,600 (year 2023) on the analyzed section of US Highway 101.

The vehicle mix on the U.S. 101 Highway is 96% automobiles, 2% medium trucks, and 2% heavy trucks (data provided by ATE/Caltrans). The input into the computer model includes the above existing and future traffic volumes and vehicle mix, with an average vehicle speed of 60 mph along the U.S. 101 Highway. This modeled average vehicle speed correlated well with the results of the noise measurements. The results of our future exterior noise analysis are summarized in *Table 3*.



● Noise Modeling Location

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Table 3
Year 2023 - Modeled Exterior Noise Levels (Ldn)

Location	2 nd Floor Façade	1 st Floor Façade	1 st Floor Patio
Residence at 529 West Junipero Street	65 L _{dn}	60 L _{dn}	59 L _{dn}
Hospital Building	63 L _{dn}	59 L _{dn}	N/A
Hospital Building (at garden area with pathways and seating areas)			65 L _{dn}

4.1 FINDINGS - FUTURE VEHICLE NOISE ANALYSIS

4.1.1 Exterior Noise Levels

The data shown in Table 3 indicate future (Year 2023) U.S. Highway 101 traffic noise levels at the site to range from 59 dBA Ldn to 65 dBA Ldn. The 59 dBA Ldn noise level predicted in the project's outdoor living areas (private ground floor patios) meets the City of Santa Barbara 60 dB Ldn exterior noise level compatibility criteria without mitigation. The remainder of the outdoor living areas and open space areas are expected to have lower than the modeled location 59 dBA Ldn noise exposure level from the U.S. 101 Highway, due to their larger distances to the noise source (i.e., US Highway 101) and noise shielding by intervening buildings and structures.

The "normally acceptable" noise exposure is 65 dBA Ldn for hospitals. The future noise level at the hospital garden area between the proposed main building and Mission Creek is calculated to be 65 dBA Ldn or less. Therefore, this outdoor area would meet the 65 dBA Ldn noise criterion.

4.1.2 Interior Noise Levels

The data in *Table 3* indicate that future noise levels at the buildings' façades are estimated to range between 59 and 65 dBA Ldn. Standard construction materials and techniques used for new developments in Southern California normally result in a minimum exterior to interior noise attenuation of 12 dBA with windows open, and 20 dBA with windows closed. Therefore, the interior noise level in the project buildings is expected to range between 47 and 53 dBA Ldn

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with windows open and between 39 and 45 dBA Ldn with windows closed. The noise levels with windows open would exceed the City of Santa Barbara 45 dBA Ldn interior noise level requirement for residential and hospital uses. The noise levels with the windows closed would meet the City of Santa Barbara 45 dBA Ldn interior noise level requirement for the uses within the project. The modeling locations represent a worse case situation and the remainder of the buildings and residences are expected to have even lower interior noise levels due to orientation, shielding by buildings and structures, and greater distances to the U.S. 101 Highway.

In conclusion, the habitable spaces of the project's hospital and residential uses are anticipated to meet the 45 dBA Ldn interior noise standard, with a windows closed condition. This means that the design for the project's habitable rooms must include a means by which adequate ventilation can be provided with the windows closed, i.e., mechanical ventilation and/or air conditioning. The mechanical ventilation should be designed and constructed to meet the Uniform Building Code minimum ventilation rate requirements.

5.0 PLAYGROUND NOISE IMPACT ANALYSIS

The playground noise levels at the project site have been calculated using the following formulae:

$$\text{Leq/hr} = \text{SEL}_{\text{ref}} + 10 \log (N) - 20 \log (d/100) - 35.6$$

In which:

Leq/hr = the 1-hourly average playground sound level (dBA)

SEL_{ref} = sound exposure reference level (1 child: 63 dBA at 100 feet)

N = number of children (45)

d = acoustic center equivalent distance to the receiver location
(100 feet for main building, and 200 feet for nearest residence)

Using sound levels monitored at similar nursery schools (1 child up to 63 dBA at 100 feet distance), and information provided by Oaks Nursery Preschool (up to 45 children playing outside between 8:00 a.m. and 12:30 p.m.), the playground average hourly Leq noise level is computed to range between 44 dBA and the main building façade and 38 dBA at the nearest residential unit. These noise levels are well below the 54 to 59 dBA Leq existing noise levels monitored near the proposed residential units along West Junipero Street (monitor location 1, Figure 4). Consequently, the playground noise impacts upon the proposed project are

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considered *less than significant*.

6.0 COMBINED TRAFFIC AND PLAYGROUND NOISE IMPACT ANALYSIS

As noted in Section 5.0 above, the playground average hourly Leq noise level is calculated to range between 44 dBA at the main building façade and 38 dBA at the nearest residential unit. These noise levels are well below the below the 54 to 59 dBA Leq existing noise levels monitored near the proposed residential units along West Junipero Street. When combining the noise levels for the two noise sources, the playground noise has a negligible contribution (i.e., 0 dBA) to the overall combined noise level (both in terms of the hourly Leq and the Ldn values). Thus, combined noise level is the same as the traffic noise level.

7.0 CONSTRUCTION NOISE IMPACT ANALYSIS

Construction noise is temporary phenomenon. Construction noise levels will vary from hour-to-hour and day-to-day, depending on the equipment in use, the operations being performed, and the distance between the source and receptor. The project's construction potentially impacting the existing noise and vibration environment at the site include:

- *Demolition of existing structures.* Sources include dozers, excavators, front loaders, and trucks.
- *Site preparation.* Sources include trucks, backhoes, front-end loaders, and pavers.
- *Construction of foundations.* Sources include concrete trucks and mixers.
- *Facade and interior construction.* Sources include hammering, drilling, generators, compressors, and light truck traffic.
- *Mechanical Equipment systems installation.* Sources include hammering, drilling, generators, compressors, and light truck traffic.

The Environmental Protection Agency (EPA) has compiled data regarding the noise-generating characteristics of specific types of construction equipment. The typical maximum noise levels for various pieces of construction equipment at a distance of 50 feet are presented in Table 4.

Note that the equipment noise levels presented in Table 4 are maximum noise levels. The equipment operates in alternating cycles at various power levels, thus, producing variable noise levels, lower than the maximum equipment noise levels. The average sound level of the construction activity also depends upon the amount of time that the equipment operates, and

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the intensity of the construction during the time period.

The maximum equipment noise levels at 50 feet distance shown in Table 4 decrease with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. The nearest sensitive receptors are located at approximately 100 feet -or more- distance from the project's major construction activities. The equipment distance sound attenuation for 100 feet would be 6 dBA, resulting in maximum noise levels ranging between 76 to 82 dBA for "typical" equipment and between 69 to 77 dBA for "quiet" equipment at this distance.

It is anticipated that the greatest one-hour average noise level occurs during ground clearing and rock removal activities. Construction equipment used during this construction phase typically includes scrapers, dozers, compactors, and water trucks. Dudek has conducted noise measurements during operation of graders, bulldozers, loaders, water trucks, etc. Based on those noise measurements, the one-hour average noise level during ground clearing and rock removal activities ranges from approximately 75 to 80 dBA at 50 feet from the closest construction work area. At 100 feet distance, the one-hour average noise level during ground clearing and rock removal activities are estimated to range from approximately 69 to 74 dB.

The maximum and one-hour average noise levels can be further reduced by installing a temporary 8 to 10 feet high wall around the construction site. This temporary wall can be made of wood (minimum 5/8 inch thick), and should present a solid surface, without openings or gaps.

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Table 4		
Construction Equipment Noise Levels¹		
Equipment Type	"Typical" Equipment dBA at 50 ft	"Quiet" ² Equipment dBA at 50 ft
Backhoe	85	80
Truck, Crane	88	80
Dozer	87	83
Loader	84	80
Pavers	88	80
Pneumatic Tools	85	75
Shovel	82	80
Trucks	88	83
¹ Source: Environmental Protection Agency (EPA)		
² Quieted Equipment: with enclosures, mufflers, or other noise-reducing features.		

7.1 FINDINGS - CONSTRUCTION NOISE IMPACT ANALYSIS

Although it can be expected that construction of the project could create short-term noise disturbances for residences, and people near the project site, these potential disturbances can be minimized by implementation of the City's Noise Ordinance time limitations for construction (i.e., no construction between the hours of 8:00 p.m. of any day and 7:00 a.m. of the following day), and the installation of a temporary wall around the construction site.

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8.0 MECHANICAL EQUIPMENT NOISE IMPACTS

The City's Noise Ordinance, Chapter 9.16.025 - Regulation of Noise Affecting Parcels Zoned or Used for Residential Purposes - includes guidelines applicable to the project's mechanical equipment noise levels. The City's Noise Ordinance, Chapter 9.16.025 Section C. Noise Limitations., stipulates:

"All mechanical equipment other than vehicles shall be insulated and sound at the property line of any adjacent parcel used or zoned for residential, institutional or park purposes shall not exceed sixty A-weighted decibels using the Community Noise Equivalent Level 60 dBA CNEL."

In order to meet the City's Noise Ordinance allowable 60 dBA CNEL noise level limits at the property line of any adjacent parcel used or zoned for residential, educational, institutional or park purposes, the project design and equipment selection will need to include equipment noise attenuation considerations. A detailed analysis of the necessary equipment noise attenuation measures should be made by an acoustical engineer during the project's design phase, when detailed equipment location, capacities, and noise levels become available. The following provides a generic summary of measures that should be considered during the project design and equipment selection process:

- **Air Conditioning and Ventilation Systems** - Air conditioning and ventilation systems for the project are expected to include rooftop HVAC, air-cooled condensers, and exhaust ventilation systems for the building and parking garage. The project design will need to include equipment location considerations, i.e., consider locating the units as far as possible from noise sensitive areas. Installation of the exhaust fans in mechanical rooms or in acoustically designed enclosures may be necessary to reduce the fan noise levels below the City's 60 dBA CNEL Noise Ordinance standards. Additional measures may include specifying quieted equipment, with lower-speed reduced-noise fans, installing mufflers or acoustical lining in both the air intake and discharge sides of the fans, etc.
- **Transformers** – Noise from transformers (if applicable) can be addressed by purchasing high-efficiency reduced-noise transformers and by installing acoustical barrier walls or partial or full acoustical enclosures around the transformers. High-efficiency transformers are designed to have lower internal magnetic flux densities and lower magnetostrictive forces, hence, lower overall noise emissions, than "standard" transformers.

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- Miscellaneous Equipment – The project's miscellaneous equipment and electro motor driven pumps, air compressors, and heaters can be purchased with specified noise limits, and be installed inside the buildings, or in smaller, acoustically-designed enclosures, as appropriate.

8.1 FINDINGS - MECHANICAL EQUIPMENT NOISE IMPACTS

With the proper acoustical design and equipment selection, it is anticipated that the noise generated by the project's mechanical equipment would meet the City's Noise Ordinance noise standards and the noise impacts would be less than significant.

* * * * *

This completes our Environmental Noise Study Report for the proposed Santa Barbara Cancer Center project located in the City of Santa Barbara, California. Should you have any questions regarding the above information, please do not hesitate to contact me at (805) 963-0651 or coverweg@dudek.com.

Respectfully submitted,

DUDEK



Mike Komula
Senior Acoustician

Enclosures: *Attachments A, B*

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REFERENCES

California Department of Transportation (Caltrans).

California Vehicle Noise Emission Levels, (FHWA/CA/TL-87/03).

City of Santa Barbara, August 1979.

City of Santa Barbara General Plan Noise Element.

Scott A. Schell, AICP, Associated Transportation Engineers (ATE).

U.S. Highway 101 traffic data.

ATTACHMENT "A"

ACOUSTICAL TERMS AND DEFINITIONS

<u>Term</u>	<u>Definition</u>
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
A-Weighted Sound Level	<u>dBA</u> is the sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Community Noise Equivalent Level	<u>CNEL</u> is the A-weighted equivalent continuous sound exposure (CNEL) level for a 24-hour period with a ten dB adjustment added to sound levels occurring during nighttime hours (10 pm to 7 am) and a five dB adjustment added to the sound levels occurring during the evening hours (7 pm to 10 pm).
Day / Night Noise Equivalent Level	<u>Ldn</u> is the A-weighted equivalent continuous sound exposure level for a 24-hour period with a ten dB adjustment added to sound levels occurring during nighttime hours (10 pm to 7 am).
Decibel	<u>dB</u> is the unit for measuring sound pressure level, equal to 10 times the logarithm to the base 10 of the ratio of the measured sound pressure squared to a reference pressure, which is 20 micro-Pascal.
Time-Average Sound Level	<u>TAV</u> is the sound level corresponding to a steady state sound level and containing the same total energy as a time varying signal over a given sample period. TAV is designed to average all of the loud and quiet sound levels occurring over a specific time period.

ATTACHMENT "B"

VEHICLE NOISE CALCULATIONS

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL							DUDEK
		(modified for LDN)					
PROJECT:	Santa Barbara Cancer Center Project, Santa Barbara				JN:	5216	
ROADWAY:	US 101 - Existing				DATE:	03-Mar-08	
LOCATION:	Monitor Location 1 - 2nd Floor				BY:	C.OVERWEG	
CALIBRATION: Leq Day Monitored: 59 dBA							
ADT	138,000	Existing			PK HR VOL	13,800	
SPEED	60						
PK HR %	10						
DIST CTL	560						
DIST N/F	76				AUTO SLE DISTANCE	555.1	
DIST EX BLDG	120				MED TRUCK SLE DIST	554.8	
DIST W/OB	440				HVY TRUCK SLE DIST	554.2	
HTH EX BLDG	17.0						
HTH OBS	17.0						
AMBIENT	0						
ROADWAY VIEW:							
LF ANGLE	-90						
RT ANGLE	90						
DF ANGLE	180						
SITE CONDITIONS: (10=HARD SITE, 15=SOFT SITE)							
AUTOM	15.0						
MED TR	15.0						
HVY TR	10.0						
BARRIER	0		(0=WALL, 1=BERM)				
ELEVATIONS:							
PAD	0.0		AUTOMOBILES =	0.00			
ROAD	0.0		MEDIUM TRUCKS=	2.30			
			HEAVY TRUCKS =	8.01			
GRADE:	0.0 %		GRADE ADJUSTM=	0.0	(TO HEAVY TRUCKS)		
VEHICLE DISTRIBUTION:							
			DAY	EVE	NIGHT	DAILY	
AUTOMOBILES			0.775	0.140	0.105	0.9600	
MEDIUM TRUCKS			0.490	0.022	0.490	0.0200	
HEAVY TRUCKS			0.473	0.054	0.473	0.0200	
NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
AUTOMOBILES	64.4		62.5	61.1	55.0	63.5	
MEDIUM TRUCKS	58.0		54.1	46.7	55.4	61.6	
HEAVY TRUCKS	68.1		64.1	60.7	65.3	71.5	
VEHICULAR NOISE	69.9		66.6	64.0	66.1	72.5	
NOISE IMPACTS WITH TOPO AND BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
VEHICULAR NOISE	62.4		59.1	56.5	58.6	65.0	
AMBIENT:							
				W/O AMBIENT		W/ AMBIENT	
LEQ PK HR WITHOUT TOPO OR BARRIER				69.9		69.9	
LEQ PK HR WITH TOPO OR BARRIER				62.1	*****	62.1	
LDN WITHOUT TOPO AND BARRIER				72.5		72.5	
LDN WITH TOPO AND BARRIER				65.0	*****	65.0	

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL							DUDEK
		(modified for LDN)					
PROJECT:	Santa Barbara Cancer Center Project, Santa Barbara				JN:	5216	
ROADWAY:	US 101 - Year 2023				DATE:	03-Mar-08	
LOCATION:	Residence - 529 West Junipero Street - 2nd Floor Façade				BY:	C.OVERWEG	
ADT	165,600	Year 2023			PK HR VOL	16,560	
SPEED	60						
PK HR %	10						
DIST CTL	600						
DIST N/F	76				AUTO SLE DISTANCE	595.1	
DIST EX BLDG	120				MED TRUCK SLE DIST	594.8	
DIST W/OB	480				HVY TRUCK SLE DIST	594.2	
HTH EX BLDG	17.0						
HTH OBS	17.0						
AMBIENT	0						
ROADWAY VIEW:							
LF ANGLE	-90						
RT ANGLE	90						
DF ANGLE	180						
SITE CONDITIONS: (10=HARD SITE, 15=SOFT SITE)							
AUTOM	15.0						
MED TR	15.0						
HVY TR	10.0						
BARRIER	0		(0=WALL,1=BERM)				
ELEVATIONS:							
PAD	0.0		AUTOMOBILES =		0.00		
ROAD	0.0		MEDIUM TRUCKS=		2.30		
			HEAVY TRUCKS =		8.01		
GRADE:	0.0 %		GRADE ADJUSTM=		0.0	(TO HEAVY TRUCKS)	
VEHICLE DISTRIBUTION:							
			DAY	EVE	NIGHT	DAILY	
AUTOMOBILES			0.775	0.140	0.105	0.9600	
MEDIUM TRUCKS			0.490	0.022	0.490	0.0200	
HEAVY TRUCKS			0.473	0.054	0.473	0.0200	
NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
AUTOMOBILES	64.7		62.8	61.4	55.4	63.8	
MEDIUM TRUCKS	58.4		54.5	47.0	55.7	61.9	
HEAVY TRUCKS	68.6		64.6	61.2	65.8	72.0	
VEHICULAR NOISE	70.4		67.0	64.4	66.6	73.0	
NOISE IMPACTS WITH TOPO AND BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
VEHICULAR NOISE	62.8		59.4	56.8	59.0	65.4	
AMBIENT:							
				W/O AMBIENT		W/ AMBIENT	
LEQ PK HR WITHOUT TOPO OR BARRIER				70.4		70.4	
LEQ PK HR WITH TOPO OR BARRIER				62.5	*****	62.5	
LDN WITHOUT TOPO AND BARRIER				73.0		73.0	
LDN WITH TOPO AND BARRIER				65.4	*****	65.4	

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL							DUDEK
		(modified for LDN)					
PROJECT:	Santa Barbara Cancer Center Project, Santa Barbara				JN:	5216	
ROADWAY:	US 101 - Year 2023				DATE:	03-Mar-08	
LOCATION:	Residence - 529 West Junipero Street - 1st Floor Façade				BY:	C.OVERWEG	
ADT	165,600	Year 2023			PK HR VOL	16,560	
SPEED	60						
PK HR %	10						
DIST CTL	550						
DIST N/F	76				AUTO SLE DISTANCE	545.3	
DIST EX BLDG	120				MED TRUCK SLE DIST	544.9	
DIST W/OB	430				HVY TRUCK SLE DIST	544.3	
HTH EX BLDG	17.0						
HTH OBS	5.0						
AMBIENT	0						
ROADWAY VIEW:							
LF ANGLE	-90						
RT ANGLE	90						
DF ANGLE	180						
SITE CONDITIONS: (10=HARD SITE, 15=SOFT SITE)							
AUTOM	15.0						
MED TR	15.0						
HVY TR	15.0						
BARRIER	0		(0=WALL, 1=BERM)				
ELEVATIONS:							
PAD	0.0		AUTOMOBILES =		0.00		
ROAD	0.0		MEDIUM TRUCKS=		2.30		
			HEAVY TRUCKS =		8.01		
GRADE:	0.0 %		GRADE ADJUSTM=		0.0 (TO HEAVY TRUCKS)		
VEHICLE DISTRIBUTION:							
			DAY	EVE	NIGHT	DAILY	
AUTOMOBILES			0.775	0.140	0.105	0.9600	
MEDIUM TRUCKS			0.490	0.022	0.490	0.0200	
HEAVY TRUCKS			0.473	0.054	0.473	0.0200	
NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
AUTOMOBILES	65.3		63.4	62.0	55.9	64.4	
MEDIUM TRUCKS	58.9		55.0	47.6	56.3	62.5	
HEAVY TRUCKS	62.6		58.5	55.1	59.8	66.0	
VEHICULAR NOISE	67.8		65.1	62.9	62.5	69.3	
NOISE IMPACTS WITH TOPO AND BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
VEHICULAR NOISE	58.3		55.6	53.5	53.0	59.9	
AMBIENT:							
				W/O AMBIENT		W/ AMBIENT	
LEQ PK HR WITHOUT TOPO OR BARRIER				67.8		67.8	
LEQ PK HR WITH TOPO OR BARRIER				57.9		57.9	
LDN WITHOUT TOPO AND BARRIER				69.3		69.3	
LDN WITH TOPO AND BARRIER				59.9		59.9	

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL						DUDEK	
		(modified for LDN)					
PROJECT:	Santa Barbara Cancer Center Project, Santa Barbara				JN:	5216	
ROADWAY:	US 101 - Year 2023				DATE:	03-Mar-08	
LOCATION:	Residence - 529 West Junipero Street - 1st Floor Patio				BY:	C.OVERWEG	
ADT	165,600	Year 2023			PK HR VOL	16,560	
SPEED	60						
PK HR %	10						
DIST CTL	600						
DIST N/F	76				AUTO SLE DISTANCE	595.2	
DIST EX BLDG	120				MED TRUCK SLE DIST	594.9	
DIST W/OB	480				HVY TRUCK SLE DIST	594.3	
HTH EX BLDG	17.0						
HTH OBS	5.0						
AMBIENT	0						
ROADWAY VIEW:							
LF ANGLE	-90						
RT ANGLE	90						
DF ANGLE	180						
SITE CONDITIONS:		(10=HARD SITE, 15=SOFT SITE)					
AUTOM	15.0						
MED TR	15.0						
HVY TR	15.0						
BARRIER	0	(0=WALL,1=BERM)					
ELEVATIONS:							
PAD	0.0		AUTOMOBILES =	0.00			
ROAD	0.0		MEDIUM TRUCKS=	2.30			
			HEAVY TRUCKS =	8.01			
GRADE:	0.0 %		GRADE ADJUSTM=	0.0	(TO HEAVY TRUCKS)		
			VEHICLE DISTRIBUTION:				
			DAY	EVE	NIGHT	DAILY	
AUTOMOBILES			0.775	0.140	0.105	0.9600	
MEDIUM TRUCKS			0.490	0.022	0.490	0.0200	
HEAVY TRUCKS			0.473	0.054	0.473	0.0200	
		NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:					
		LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
AUTOMOBILES		64.7	62.8	61.4	55.4	63.8	
MEDIUM TRUCKS		58.4	54.5	47.0	55.7	61.9	
HEAVY TRUCKS		62.0	58.0	54.6	59.2	65.4	
VEHICULAR NOISE		67.2	64.5	62.3	61.9	68.7	
		NOISE IMPACTS WITH TOPO AND BARRIER SHIELDING:					
		LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
VEHICULAR NOISE		57.8	55.1	53.0	52.5	59.3	
AMBIENT:				W/O AMBIENT	W/ AMBIENT		
LEQ PK HR WITHOUT TOPO OR BARRIER				67.2		67.2	
LEQ PK HR WITH TOPO OR BARRIER				57.3	*****	57.3	
LDN WITHOUT TOPO AND BARRIER				68.7		68.7	
LDN WITH TOPO AND BARRIER				59.3	*****	59.3	

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL							DUDEK
				(modified for LDN)			
PROJECT:	Santa Barbara Cancer Center Project, Santa Barbara					JN:	5216
ROADWAY:	US 101 - Year 2023					DATE:	03-Mar-08
LOCATION:	Hospital - 2nd Floor Façade					BY:	C.OVERWEG
ADT	165,600	Year 2023				PK HR VOL	16,560
SPEED	60						
PK HR %	10						
DIST CTL	620						
DIST N/F	76				AUTO SLE DISTANCE		615.1
DIST WALL	120				MED TRUCK SLE DIST		614.8
DIST W/OB	500				HVY TRUCK SLE DIST		614.2
DIST EX BLDG	17.0						
DIST W/OB	17.0						
HTH EX BLDG	0						
ROADWAY VIEW:							
LF ANGLE	-10						
RT ANGLE	90						
DF ANGLE	100						
SITE CONDITIONS: (10=HARD SITE, 15=SOFT SITE)							
AUTOM	15.0						
MED TR	15.0						
HVY TR	10.0						
BARRIER	0	(0=WALL, 1=BERM)					
ELEVATIONS:							
PAD	0.0		AUTOMOBILES =	0.00			
ROAD	0.0		MEDIUM TRUCKS=	2.30			
			HEAVY TRUCKS =	8.01			
GRADE:	0.0 %		GRADE ADJUSTM=	0.0	(TO HEAVY TRUCKS)		
VEHICLE DISTRIBUTION:							
			DAY	EVE	NIGHT		DAILY
AUTOMOBILES			0.775	0.140	0.105		0.9600
MEDIUM TRUCKS			0.490	0.022	0.490		0.0200
HEAVY TRUCKS			0.473	0.054	0.473		0.0200
NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:							
		LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT		LDN
AUTOMOBILES		64.5	62.6	61.2	55.2		63.6
MEDIUM TRUCKS		58.1	54.3	46.8	55.5		61.7
HEAVY TRUCKS		65.9	61.9	58.5	63.1		69.3
VEHICULAR NOISE		68.7	65.6	63.2	64.4		70.9
NOISE IMPACTS WITH TOPO AND BARRIER SHIELDING:							
		LEQ PK HR	LEQ DAY	LEQ EVE	LEQ NIGHT		LDN
VEHICULAR NOISE		60.9	57.8	55.3	56.6		63.1
AMBIENT:							
				W/O AMBIENT		W/ AMBIENT	
LEQ PK HR WITHOUT TOPO OR BARRIER				68.7			68.7
LEQ PK HR WITH TOPO OR BARRIER				60.4	*****		60.4
LDN WITHOUT TOPO AND BARRIER				70.9			70.9
LDN WITH TOPO AND BARRIER				63.1	*****		63.1

FHWA - HIGHWAY TRAFFIC NOISE PREDICTION MODEL							DUDEK
		(modified for LDN)					
PROJECT:	Santa Barbara Cancer Center Project, Santa Barbara				JN:	5216	
ROADWAY:	US 101 - Year 2023				DATE:	03-Mar-08	
LOCATION:	Hospital - 1st Floor Façade				BY:	C.OVERWEG	
ADT	165,600	Year 2023			PK HR VOL	16,560	
SPEED	60						
PK HR %	10						
DIST CTL	620						
DIST N/F	76				AUTO SLE DISTANCE	615.2	
DIST EX BLDG	120				MED TRUCK SLE DIST	614.9	
DIST W/OB	500				HVY TRUCK SLE DIST	614.3	
HTH EX BLDG	17.0	*****					
HTH OBS	5.0						
AMBIENT	0						
ROADWAY VIEW:							
LF ANGLE	-10						
RT ANGLE	90						
DF ANGLE	100						
SITE CONDITIONS: (10=HARD SITE, 15=SOFT SITE)							
AUTOM	15.0						
MED TR	15.0						
HVY TR	15.0						
BARRIER	0		(0=WALL, 1=BERM)				
ELEVATIONS:							
PAD	0.0		AUTOMOBILES =	0.00			
ROAD	0.0		MEDIUM TRUCKS=	2.30			
			HEAVY TRUCKS =	8.01			
GRADE:	0.0 %		GRADE ADJUSTM=	0.0	(TO HEAVY TRUCKS)		
VEHICLE DISTRIBUTION:							
			DAY	EVE	NIGHT	DAILY	
AUTOMOBILES			0.775	0.140	0.105	0.9600	
MEDIUM TRUCKS			0.490	0.022	0.490	0.0200	
HEAVY TRUCKS			0.473	0.054	0.473	0.0200	
NOISE IMPACTS WITHOUT TOPO OR BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
AUTOMOBILES	64.5		62.6	61.2	55.2	63.6	
MEDIUM TRUCKS	58.1		54.3	46.8	55.5	61.7	
HEAVY TRUCKS	61.8		57.8	54.3	59.0	65.2	
VEHICULAR NOISE	67.0		64.3	62.1	61.7	68.5	
NOISE IMPACTS WITH TOPO AND BARRIER SHIELDING:							
	LEQ PK HR		LEQ DAY	LEQ EVE	LEQ NIGHT	LDN	
VEHICULAR NOISE	57.6		54.9	52.8	52.3	59.1	
AMBIENT:							
				W/O AMBIENT		W/ AMBIENT	
LEQ PK HR WITHOUT TOPO OR BARRIER				67.0		67.0	
LEQ PK HR WITH TOPO OR BARRIER				57.1	*****	57.1	
LDN WITHOUT TOPO AND BARRIER				68.5		68.5	
LDN WITH TOPO AND BARRIER				59.1	*****	59.1	